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ABSTRACT

Papers and discussants' comments from a symposium on issues concerning infants' reactions to strangers are presented. Researchers agreed that there is a developmental shift in infant behavior at 7 to 9 months of age when the infant becomes more cautious in approaching strangers. However, investigators hypothesize that the presence of the mother, the mother-child relationship, or the context in which the child-stranger interactions occur may affect the strength and quality of that interaction in differing ways. Symposium discussants suggest that infant fear of strangers may not be as prevalent or as unidimensional as once supposed. Suggestions are made for more precise research methods, observational techniques, and behavioral scoring. (BRT)

INFANTS' REACTIONS TO UNFAMILIAR ADULTS: A DISCUSSION OF SOME IMPORTANT ISSUES*

Robert J. Harmon & George A. Morgan (Chairs)

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*Papers and discussants' comments from a symposium presented at the biennial meeting of the Society for Research in Child Development, Denver, April, 1975.

This document includes the prepared remarks of each of the seven symposium participants. Since the presentations were relatively brief, there was time after each discussant's comments for exchanges among the panel members and with the audience. This discussion was an important aspect of the symposium, but because it was spontaneous, it is not included in this document. To supplement the presentations, we have appended an extensive bibliography which includes papers referred to by the participants and most other recent articles concerning human infants' reactions to unfamiliar persons. The names and addresses of participants are listed below.

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Overview

Robert J. Harmon

The interaction between an unfamiliar adult or stranger and an infant has been studied by researchers of diverse interest, including those concerned with early childhood milestones, psychoanalytic theories of fear or anxiety, social interaction, attachment, and exploration. A great deal of data has been compiled about the reactions to these unfamiliar persons who have approached babies in a variety of ways. This research has resulted in some areas of agreement which can be used to help further discussion of infants' reactions to unfamiliar adults. For example, there does seem to be a developmental shift around 7-9 months of age when infants, at the least, become more cautious in their approach to strangers. The presence of the mother and even her closeness to the infant are important in determining the type of reaction seen. The laboratory situation seems to be more upsetting than the home. Adults seem to be more threatening than children. The degree of intrusiveness of the adult also seems to be important in eliciting a more negative reaction.

In spite of the general agreement about these trends, some researchers have felt that "fear of strangers" has been overemphasized. A general area of concern which we shall discuss today relates to the recent criticism of some researchers, especially those who have used unfamiliar adults in studies of

infant exploration or social interaction. This point has been made most forcefully by Harriet Rheingold and Carol Eckerman who feel that fussing or crying to a stranger is a rare event and only occurs in unusual circumstances. In addition, it has been questioned whether what one scores should include all important behaviors, or only those the investigator may be interested in. For example, have researchers who are mostly interested in fear looked at positive behaviors or only negative ones? The emphasis on "fear" has also been challenged and an important point made that infants often accept strangers and interact with them.

These criticisms do not mean that "fear of strangers" is no longer an important research area. Because investigators have used an unfamiliar adult for different purposes, they have used different contexts and methodologies and reached different conclusions about infants' reactions. During this symposium these differences will be explored by the participants with the aim of discussing what constitutes an appropriate context and methodology, consistent with one's own research interests and purpose. For example, the issue of how one scores, whether by discrete behaviors or a rating scale, may be dependent on what one is interested in studying. Likewise, for those who want to study the development of fear, positive responses may be less relevant to their interest.

Infants Reactions to Strangers vs. Mothers

Robert P. Klein and Joan T. Durfee

Recent research on fear of strangers in infancy has shown that the phenomenon is not nearly so universal as once claimed. Not only do many children fail to show fear but those children who do show fear on one occasion may well not do so on the next. Furthermore, variations in the characteristics and actions of the stranger have a large effect on the incidence of fear reactions.

These results have caused many researchers to down play this phenomenon and to suggest that it is mostly an artifact of artifical experimental procedures. The suggestion has been made that were the child's mother to approach her infant in the same way as some experimenters do, the child might show as much fear of his mother as he does of the stranger. A few studies have been done which contain data pertinent to this question, but the results are equivocal. Infants do indeed approach mothers (and fathers) more quickly than they do strangers if the adult is passive, but their facial-vocal responses to a passive stranger are generally neutral to positive. On the other hand when actively approached infants show clear negative or neutral responses to strangers and positive responses to their mothers or familiar caregivers. The data which I will be reporting came from a situation with several unique characteristics: 1) the babies were free to move; 2) the procedure involved first trying to attract the infant rather than quickly approaching him; and 3) positive and negative behavior were treated separately.

The situation was part of a larger study on the social behavior of 12 month old infants. Using it we observed how babies reacted to an approach by a stranger versus to the same approach by their own mothers. It should be noted that the stranger had in fact observed the infant in his home for approximately four hours during the previous ten days to two weeks. The approach consisted of three steps--encouraging the baby to come over to play with a ball, touching the baby in a playful manner, and picking him up. These steps were carried out first by the stranger and immediately thereafter by the mother. The baby's reactions to the stimulating adult was rated in each step on two scales (based on those used by Ricciuti): the behavioral reaction and the hedonic reaction. Within each both the strongest positive reaction (if any) and the strongest negative reaction (if any) were scored. This produced 2x2x6 or 24 scores for each child. Within each step the positive scales were highly interrelated as were the two negative scales. Therefore, a single positive, or approach, score and a single negative, or avoidance score, was calculated for each step.

To test for the differential reaction to mother vs. stranger an analysis of variance with two repeated factors was performed on both the approach and avoidance scores. The two factors were: stimulating adult (stranger vs. mother) and step of the approach (3 levels). There was a highly significant main effect for the adult factor ($p < .01$) with both scores; that is, in each step infants approached their mothers more and avoided their mothers less than they did the stranger. This was particularly true for the pick up step. The direction of this difference is particularly interesting in view of the contention by Eckerman and Rheingold that vocalizations and smiles are the infant's way of exploring people; from this

perspective one might expect that such exploratory responses would be directed more to the novel stranger than to the familiar mother. The fact that the difference was in the opposite direction is consistent with the interpretation of greater wariness to the stranger rather than greater exploration of the stranger.

Although these differences are in the direction of wariness to the stranger, they are by no means the whole story. The results show that the infants' hesitation regarding the stranger was only relative. First, we observed a good deal of approach to the stranger. Even in the most intrusive step, the pick up step, approximately half the infants showed clear positive behavior to the stranger. In the first two steps approximately three quarters did so. From these results it can be seen that Rheingold and Eckerman in their recent critique of research on fear of strangers were quite right to insist upon a description of the positive behavior that infants show towards strangers. Secondly, infants showed some avoidance of the mother as well as of the stranger. When picked up by the stranger 40 percent reacted in a negative manner, but when picked up by their mothers 25 percent reacted negatively. Thus at least some of the distress shown by infants when being picked up by a stranger would seem to be due to the fact that this interferes with their ongoing activity, since being picked up by mother when not requested can also lead to distress.

Our results, along with those of many others, show that some infants react with distress when approached by their mothers and by no means all

infants react with distress when approached by a stranger. The evidence indicates that fear of strangers defined in terms of distress shown uniquely to approach by a stranger by virtually all infants is not a useful concept. Unfortunately the discussion of distress towards strangers has far too often been in just such either/or terms. A far more realistic approach is to view this reaction in probabilistic terms. Bowlby suggests in his most recent book that many events have the potential for eliciting fear in humans. Furthermore, the combination of two or more such events increases the likelihood that fear will be elicited. As an example, two events which Bowlby suggests have this potential are looming and exposure to a stranger. A quick approach by a stranger, which seems particularly effective in eliciting distress, combines both these events. Bowlby pays particular attention, of course, to the infant's relation with his mother. To the extent that he is unsure of her availability, even otherwise quite minor occurrences, might be frightening. At the ages at which reaction to strangers has generally been studied, a plausible hypothesis would be that the infant's attachment to his mother is still in the process of formation and therefore, the quality of that attachment can vary from day to day.

Such variations would, according to Bowlby, lead to varying responses in the same infant to approaches by stranger on different days.

If the probability of infant distress to stranger approach can vary so widely depending on the circumstances of the approach, perhaps it is not useful to ask whether infants fear strangers per se. This would be predicted by Werner's approach to mental development which contends that

the cognitions of infants are wholistic and undifferentiated.

We may be quite in error in assuming the infant can abstract out the concept of stranger from his various experiences with strangers. Being beckoned over to play with a toy by a stranger is one experience and being approached quickly by a stranger while seated in a chair some distance from the mother is quite another. From the infant's point of view there may be very little, if anything, in common between these two experiences.

Both the evidence and theoretical considerations lead to the same conclusion: approach by a stranger (or by a parent, for that matter) is hardly a simple event. Rather, it may be more profitable to view it as a compound of simpler events to which the infant's behavioral reactions may be quite complex. Note that I speak of reactions and not reaction. Most research so far has been assigned an overall score to each infant, either for each step or for the whole approach. In our data the negative correlations between the approach and avoidance scores in each step were barely significant, suggesting that these two reactions may be under the control of different aspects of the situation and, thus, that it may be unwise to combine them into a single score.

This relates to the problem of how to handle an ambivalent reaction. It seems unlikely that ambivalent reactions will turn out to be a simple, unitary phenomenon. By keeping track of the underlying components of the infant's ambivalent reaction we may be able to ascertain what behavioral tendencies are operative. This seems preferable to trying to force the complex behaviors seen into a single continuum. Thus our

view is similar to that of Bretherton and Ainsworth who have tried to go beyond simplistic notions of the basic phenomena and simplistic approaches to ascertaining their determinants.

Implications of Various Methods of Scoring Infants' Reactions to Unfamiliar Adults*

George A. Morgan and Claire A. Bennett

In recent years it has become increasingly apparent that the reactions of an infant to an unfamiliar adult are complex and variable. Any given baby is likely to show a variety of both affectively positive and negative behaviors, and the reaction may change markedly as the situation changes. Given the complexity of these reactions, it is understandable that investigators have used a variety of scoring systems. We felt that the sometimes divergent results reported in the literature were at least partly due to such differences in scoring. This hypothesis led us to think about the implications of different methods of classifying and summarizing infant's reactions to strangers. We asked how much difference the various criteria used by investigators could make for inferences about the incidence of "fear of strangers." We also asked how much difference various methods of summarizing these complex reactions could make.

To help illustrate these issues, we will draw on several studies, especially reanalyses of the data published by Henry Ricciuti and myself. That study looked at the reactions of 80 four to thirteen month old infants to several traditional, standardized approach episodes by two unfamiliar adults in a laboratory. Specific facial expressions, vocalizations and postural behaviors were recorded every three seconds during the approach episodes.

*We would like to express special appreciation for comments by Robert Klein and Joseph Campos.

Because these data were very detailed, it was possible to look at them several different ways and, thus, investigate the implications of various methods of scoring.

Affective classification. One approach which has been used is to classify infants as, on the one hand, reacting negatively or fearfully and, on the other, as reacting nonfearfully. This simple dichotomization is useful in illuminating the influence of the type of scoring. There is considerable agreement that a baby who fusses or cries is reacting negatively; however, those whose most extreme behavior is sober staring, cessation of activity, frowning, gaze aversion, or avoidance appear to have been classified differently from one study to another. Admittedly, the coding of these latter responses poses problems of interpretation, but assuming reasonable and reliable coding, there is still the issue of how they should affectively be classified.

The percentage of Morgan & Ricciuti infants classified as reacting negatively to the stranger depends a great deal on the scoring. For example, if the criterion for classification as negative is any fussing or crying, then, in our sample of 10- and 12-month infants, only 9 to 32%, depending on the situation, were negative during the interval in which they were touched by the stranger. This criterion is similar to that used by Harriet Rheingold and Carol Eckerman and the results are similar in the sense that rather small percentages of infants fussed or cried. Most investigators have also included postural avoidance as a negative reaction. When we count those infants who pulled back their body or hand as well as those who fussed and cried, the percentages of our infants classified as negative jumps to between 53 and 74% depending on the location of the baby vis a vis the mother and on the particular

stranger. If, in addition, gaze aversion, frowning, freezing, and sobering are included, up to 94% of our 10- and 12-month infants would be classified as negative toward the stranger during the most stressful episode.

This type of scoring, which includes only negative affect, masks the fact that most of the infants who expressed negative affect also showed positive behaviors toward a stranger during some part of the session. Nevertheless, it seems legitimate that those investigators, whose goal is to study potential fearfulness, focus on affectively negative behaviors. Likewise, those who are primarily interested in exploration of the unfamiliar person may focus on behaviors such as smiles, looks at, or approaches. However, we agree with Hildy Ross that a full understanding of how infants react to strangers will require that we look at positive as well as negative reactions. In any case, investigators should make clear what their focus is and what types of behaviors were recorded.

As implied above, the experimental situation or context influences the infant's reaction; furthermore, the method of scoring and classification may influence the conclusions one draws about such situational effects. For example, only 9% of the 10- and 12-month infants fussed or cried when touched while on mother's lap, but 32% expressed this kind of distress when touched while separated from mother by a few feet. When infants who avoided the stranger's touch as well as those who fussed or cried are considered together, negative affect was expressed by 62% while on the lap, and by approximately the same per cent (66) while away from mother. Thus, distance from mother seems to have an effect on the percentage of infants classified as negative if one considers only fussing or crying, but such separation does not seem to influence the percentage who avoid the stranger's touch. As Hildy Ross pointed

out, the Morgan and Ricciuti finding of less common negative reactions in a peek-a-boo type situation needs to be reassessed in light of the above findings. There was, of course, little postural avoidance in the peek-a-boo episode because the stranger did not reach out to touch the baby. There were, however, more infants smiling and fewer fussing and crying (10%) than in the most comparable situation, i.e., the approach and touching episode by the male experimenter with the infant separated from mother.

Most investigators have not been content to use only a dichotomous classification of the reaction. They have weighted and combined the behaviors in order to form one or more scales of the intensity of the infant's affective reaction. Because such scales are usually composites, they are removed from the specific behavior and may obscure some interesting aspects of it. Let us turn now to several ways in which infants' reactions to strangers are commonly summarized and to some implications of each method.

Combining behaviors. It has been common to combine the information from several behaviors with the same presumed direction of affect. That is, postural avoidance is combined with frowns, fusses and cries to form a single score or scale of negative affect. Such pooled categories have the advantages of economical presentation and perhaps better stability and cross-situational predictability. It should also be pointed out that even responses such as fusses or smiles are to some extent combinations. However, Hildy Ross, among others has made a strong case for the completeness and clarity provided by reporting the relatively specific behaviors. An intermediate position, proposed by Henry Riccuiti and used in today's paper by Klein and Durfee, is to combine only those behaviors which seem to be in the same modality or behavioral dimension. That is, postural approach-avoidance behaviors form one scale and

facial-vocal affect forms another. The usefulness of keeping these aspects of the reaction separate is indicated by the only moderate correlations we find between degree of avoidance and degree of facial-vocal distress. Furthermore, as implied earlier, we saw relatively little fussing or crying. Pulling back when touched was, in our situation, the main indicator of whether or not an infant was negative toward a stranger. This fact was not obvious when we combined the several types of negative behaviors into one scale.

Summarizing over time and steps of an approach sequence. It is also common to derive some sort of composite score for the several steps of a stranger approach; that is, to summarize over time. This type of score is useful in providing an overall indication of the reaction and in giving emphasis to repeated or continuous behaviors. However, it will obscure changes in affect which take place during the approach. For example, in approximately half our approach episodes, there were substantial changes in the intensity and/or direction of affect from the steps in which the stranger was some distance from the infant to the steps in which he or she was near and touching. Furthermore, the relatively modest correlations between steps indicates that it is hard to predict an infant's reaction to being touched from his reaction to being talked to from a distance. Thus, a step by step or sequential analysis of the data seems desirable and is now in process.

Summarizing positive and negative affect. It is also usually assumed that positive and negative behaviors form opposite ends of a single dimension and, thus, can be combined algebraically to form one scale of affect. However, this common assumption must be questioned because with both the Klein and Durfee data and ours there are only moderately negative correlations between separate scales of positive and negative affect. Furthermore, such scores will conceal

the occurrence of concurrent positive and negative reactions. Although it was generally uncommon for an infant to show nearly simultaneous indications of positive and negative behaviors, about one-third of our 10- and 12-month old infants did show such apparently mixed affect during the 10-second step in which the stranger offered his hand and then touched the baby.

For example, some babies pulled back, then moments later touched the stranger's hand; others reached out then pulled back; and a few alternated between approach and avoidance. There were also some patterns, such as smiling while pulling back, where behaviors in different modalities seemed to signal contrasting affect. These examples of concurrent mixed affect plus our finding (similar to Ruth Solomon-Shaffran's) that most 10- and 12-month infants react generally negatively to some stranger approaches, but positively to others seems to indicate that infants view an unfamiliar person both as an interesting, attractive object to be explored and also as a potentially threatening one to be avoided. Whatever the explanation for these mixed reactions, the point we want to make is that they would be obscured if one obtained only a measure of the predominate affect.

In conclusion, we have shown that different methods of affective classification can lead to quite different conclusions about the frequency of occurrence of "fear of strangers." We have also shown that each of the several methods of summarizing infants' reactions covers up an aspect of these complex behavior patterns. However, for any given study, an investigator will probably not be concerned with all of these aspects of the infants' reaction and will decide to report some sort of summary score. Nevertheless, we feel that it is desirable to collect behaviorally specific data. If this is done,

summary scores can be based on empirical as well as theoretical considerations, and the findings can be discussed in behavioral terms.

Discussant's Comments

Hildy S. Ross

The fundamental empirical question with which we are concerned is how do infants react to strangers. The recent emphasis on affiliative and exploratory reactions, in addition to fearful ones, has led to efforts to re-open and investigate this question objectively. It may be possible for some of us to concentrate on particular subsets of reactions, such as fear or exploration or affiliation, as both Robert Harmon and George Morgan suggest; however, our ability to understand each phenomenon requires that we take full account of the others. And then the danger in our concentration on only one type of response is that the different systems of responses may be studied with such divergent methodologies that integration would become an impossible task. Thus there is some danger in the "peacemakers'" suggestion that we each go our own way.

I agree completely with George Morgan's statement that detailed and behaviorally specific data must be collected. I'd extend that and say that there are very few instances in which it should not be reported as well. If we want to know how the infant reacts to a stranger, we cannot be satisfied with an answer that indicates "he either fussed or cried or pulled back his body or hand, averted his gaze, frowned, froze or sobered," each in some unspecified amount. We must know which responses occurred, how often, perhaps how long they lasted or what sequential patterns they assumed. If we want to know how the strangers' behavior influences the infants' reactions, we must specify what reactions were affected--gaze aversion or smiling--sobering or crying--approaching or frowning. Similarly, the information that infants were more likely to "approach" and less likely to "avoid" their mothers than a stranger, presented today by Robert Klein, is difficult to assess given that he did not specify what constituted approach and avoidance, or furthermore, indicate how much of either category of reaction was actually observed. His most intriguing finding that a substantial proportion of infants also avoided their mothers when they were picked up would be even more interesting if the constituents of avoidance were known.

George Morgan's data also illustrate the potential problems inherent in presenting summary scores. When the different responses were separated, he found that pulling back when touched was the chief "negative" behavior. This information should be considered in light of the fact that Morgan and Ricciuti previously reported that 10- and 12-month-old infants became increasingly negative as the stranger drew near and touched them. Further, the infants' reactions were positive when the stranger didn't touch them but played peek-a-boo instead. The interpretation of these findings might now differ, given that the chief indicant of a negative reaction was almost exclusively appropriate to a situation in which the infant was touched.

The one situation in which a summary score might be appropriate is when the infants' reactions are used as a test to indicate individual differences among infants or to predict future capacities or characteristics. Recent evidence, however, cautions against the premature derivation of such scores. Negative reactions are not always stable. The correlations between positive and negative scores and between apparent indices of fear in different response systems are low. We are unable to predict the infant's reactions to being touched by a stranger from his reactions to seeing the same person across the room moments earlier. Thus empirically validating a test of the infants' reactions to strangers will not be an easy task.

Finally, I applaud the comparison of the infants' reactions to his mother with his reactions to strangers. The small differences in the proportion avoiding the two adults when they were picked up illustrate that not all negative reactions to a stranger should be attributed to the stranger per se; any individual acting in the same way might elicit some similar reactions. However, labelling the mother as merely a familiar adult may be a dangerous oversimplification. The mother may be familiar, but she is also much more than familiar. The long history of mutual interaction, and the many functions the mother serves make her a highly valued person. To cite just one further complication, mother-infant familiarity is mutual--therefore the mother differs from the stranger in that she knows her own infant. Thus, even when smiling and vocalizing to a stranger are considered exploratory responses, one would not necessarily predict that these responses would be less frequently directed toward the mother. Because the mother and stranger

do not constitute points on a unitary dimension of novelty and familiarity, comparisons of the infants' reactions to them may be more valuable for the similarities, rather than the differences they reveal.

In summary

1. I see some danger in our independently pursuing different stranger reactions--though my own work does illustrate this tendency.
2. Second, I feel strongly that detailed observations must be reported. I should add that such full reports are increasingly frequent.
3. Finally, I caution against comparisons of stranger and mother that consider one an unfamiliar and the other merely a familiar adult.

Possible Operational Definitions of "Fear" and Recent Studies of "Fear of Strangers"

Joseph J. Campos

At present, we are witnessing two very contradictory trends in the area of infant emotional development. On the one hand, in the last 6 years, we have seen an unprecedented volume of research on infant emotional development, centering particularly on attachment and on the so-called "fear of strangers." On the other hand, there has been an increasingly stiff opposition to acceptance of the validity of much, and perhaps all, of this research. For example, one recent review (that of Weinraub, Brooks, & Lewis (unpublished manuscript)) called the concept of attachment "confused and restrictive," and concluded that it had little value. A second instance of sweeping criticism of much of the previous work is the review by Rheingold and Eckerman (1973), in which they wonder whether there is such a phenomenon as "fear of strangers" at all.

There has always been skepticism in the area of emotion. Duffy (1962), for example, called into question the use of all emotional designations based on a common sense vocabulary such as "fear," "anger," "happiness," and so forth. She concluded that there was no specific denotative definition of these emotional states that did not also apply to non-emotional states as well. Perhaps it is skepticism of this sort which motivated Weinraub, Brooks, and Lewis to state, "The history of the study of affect should alert us to the inescapable fact that there is relatively little correspondence between feeling and behavior." Rheingold and Eckerman, without going quite so far as Weinraub, Brooks, and Lewis, are nevertheless very skeptical about how emotional states such as "fear" are operationalized. For example, Rheingold and Eckerman are not impressed with ratings of emotional states, which they feel measure the behavior of the raters more than they do the behavior of those being rated. They also question judgments of emotional quality in the infant, in the absence of sources of validation for such judgments. They wondered to what extent "avoidance" is an appropriate index of fear, when infants can be observed to avoid their mothers on occasion. Finally, they questioned the assignment of negative weights to "sober" facial expressions in the absence of validating criteria.

Much of the present argument in the field of infant emotional development, then, hinges on issues of whether we can index emotional states: (a) with any specificity as to what emotion (if any) is being expressed, (b) with any degree of objectivity and scientific precision, and (c) with validity, construct or empirical. In the present paper, some recent developments in the operational definition of affective states will be presented because of the major implications which they may have for how we answer the above issues. Some of these developments come from within the area of infant emotion, but are either so recent or so little known, that they have not yet had a major impact. Other developments have come from areas outside the field of infancy, and have also not yet had a major impact on most researchers in the field. The developments which I am alluding to refer (a) to the use of operant conditioning to study reactions of infants to strangers and to their mothers, (b) to the relationship between heartrate (HR) acceleration and defensive or distressed responding in infants, and (c) to the study of patterns of facial expressions of emotions.

A. Operant Conditioning: Implications for the Study of Reactions to Strangers

The use of conditioning techniques to study emotion has a long and fruitful history in animal investigations (e.g., Mowrer, 1960), and terms such as "conditioned emotional response," and "conditioned fear" have entered our scientific vocabulary without much opposition. Although the experimental operations used in such studies have often been too facilely generalized to specific emotions, such as "fear," there is no doubt that conditioning techniques are useful for determining whether an environmental stimulus is positively reinforcing or aversive, Likewise, in previous studies of the so-called "fear of strangers," investigators have often been too facile in attributing crying or gaze aversion to "fear" or "anxiety" when the same response could be due to anger, disgust, or any of a number of other emotions. However, most of the propositions of interest today to researchers in the area of "fear of strangers," do not depend on whether the expressed emotion is "fear." (This is in contrast to the time when psychoanalytic theory made us focus on the implications of the experience of "anxiety" for understanding hypothetical ego-id interrelationships.) For researchers such as Rheingold, what is of central interest are propositions such as, "Do infants come to find

strangers aversive or not?" To answer such questions, the operant conditioning methodology is perfectly suited, and, in fact, has historically been the method of choice in animal studies.

A study by Fouts and Atlas (1974) recently used this potentially powerful method to study the development of infant reactions to mother versus stranger. In that study, the sight of the mother, or a stranger (who actually was the mother of a previous or subsequent infant subject), was made contingent upon a bar press. Fouts and Atlas first ascertained an operant rate for a few minutes prior to creating their experimental condition. Then, infants were presented the sight of the mother or the stranger through a window immediately after a bar press. Testing 6- and 9-month-old infants, they found that infants at BOTH ages increased bar pressing rates when the sight of the mother was contingent upon it. On the other hand, when the bar press was followed by the sight of the stranger, bar pressing rates were not significantly affected at 6 months of age, but at 9 months of age, a significant response suppression effect was obtained. In other words, at both ages tested, the sight of the mother proved to be positively reinforcing; but on the other hand, the stranger's appearance was punishing only at the older age.

The study warrants replication before broad conclusions can be made about the reinforcing properties of different persons in the child's environment. Nevertheless, the Fouts and Atlas study makes one point clear: If one wants to test sensitively the hypothesis that infants show a developmental shift to the sight of the mother or a stranger, or if one wants to measure one aspect of the "affective impact" of a person, namely aversion, this procedure seems to provide the appropriate experimental operations.

B. Psychophysiological Conceptions: Heart Rate

It is a bit surprising that psychobiological perspectives have rarely entered into the measurement of emotional states in infancy, despite the importance of such conceptions for fields such as ethology, language development, perception, and information processing. From a psychobiological orientation, it would be difficult to accept the viewpoint quoted earlier questioning the behavioral manifestation of feeling states. If we have feelings, there MUST be a biological manifestation. If none is found, we didn't look in the right place, or carefully enough.

For 10 years, we have had a psychobiological hypothesis in the field of infancy which has had the potential for advancing our study of the

psychophysiological manifestations of some emotions. This hypothesis, put forth by Graham and Clifton in 1966, linked HR deceleration with orienting responses, and HR accelerations with defensive responses. The success of this hypothesis in the study of infant deceleratory HR responses makes it doubly perplexing why we delayed investigating its converse, the acceleratory side. In the last few years, several laboratories have begun to do so, and have reported consistent relationships between HR responses and behavioral ratings of wariness and distress.

One of the early investigations of HR and emotion in infants involved the study of infants placed directly atop the deep or the shallow side of the visual cliff. An unexpected developmental shift was found in the infants' cardiac responses atop the deep side. At 2, 3, and 5 months of age, infants showed HR decelerations, while at 9 months, they showed HR accelerations. (Cardiac responses on the shallow side were essentially zero at all ages tested.) Analysis of the behavior of the infants has made clear that the shift, in accordance with predictions from the Graham-Clifton hypothesis, is one from attentiveness at 5 months and younger (when HR on the deep side is deceleratory) to wariness at 9 months (when HR is acceleratory) (Campos, in press).

Subsequent studies have focused on the link between HR reactions and behavioral reactions to strangers. Provost and Decarie (1974), for example, found that a sample of 8- to 12-month-old infants rated as behaviorally "interested" in the stranger showed HR slowing, while those rated as distressed showed large magnitude cardiac accelerations. Sroufe and his co-workers (Sroufe, Waters, & Matas, 1974; Waters, Matas, & Sroufe, in press) have reported analogous findings: infants having wary facial expressions show large-magnitude cardiac accelerations to strangers; non-wary infants do not. Also, the more stressful the environment in which the infants were tested, the greater the HR accelerations obtained.

Some of our own research also used HR to study infant reactions to strangers. One study (Campos, Emde, Gaensbauer, & Henderson, 1975) was successful in demonstrating: (a) the predicted developmental shift in cardiac reactions to strangers between 5 and 9 months of age, with 5-month-olds demonstrating deceleration on the average, and 9-month-olds acceleration, (b) the differences were not an artifact of different HR responses due to age per se, because distressed infants at both ages

showed accelerations, while non-distressed infants did not, and (c) that the presence of the mother during the approach of the stranger almost completely eliminated the significant mean HR accelerations obtained in the mother's absence.

None of these studies has claimed that HR acceleration is a measure of fear or distress, in the sense that accelerations are produced ONLY by such states. However, there is little doubt, as a result of the research just described, that HR is extremely responsive to states which can variously be described as wary, defensive, or distressed, and so can be used as an index of those states. By carefully observing the ongoing behavior of the subject while HR is recorded, investigators can rule out non-affective cardiac activation, and profit from several very substantial advantages of the HR response. Heart rate is extremely sensitive, often much more so than behavioral responses (see Campos et al., in press; Sroufe et al., 1974). It is objective, readily quantifiable, and can be used unobtrusively even in naturalistic settings (as Sroufe et al., 1974, have done). The HR response thus warrants consideration as a useful and sensitive variable for testing hypotheses dealing with infant defensiveness, distress, or wariness.

C. Facial Expressions: Behavioral and Psychophysiological Studies

The third recent development in studies of emotion, that of analysis of patterns of facial expressions, becomes particularly relevant in those cases where our hypotheses truly require greater specificity in the measurement of emotions -- that is, which require statements to be made about anger as opposed to fear, etc. The considerations put forth by Tomkins (1962), Izard (1971), and Ekman (1972) suggest that we can find such specificity in facial expressions.

Each of these investigators has been very influential in reviving interest in the facial expressions of emotion, a field which some years ago was cast into oblivion by hasty and probably erroneous conclusions about the extent to which observers can or cannot accurately judge emotional expression from facial behavior alone. All three argue persuasively that not only can judgment of emotional state be made from facial behaviors alone, but Ekman in particular feels that there are six, and perhaps seven, basic emotions (surprise, fear, happiness, anger, sadness, disgust-contempt, and possibly interest). Each has a particular pattern of facial behavior which Ekman has catalogued in what he calls the Facial Affect Scoring Technique.

Patterns of very discrete facial behaviors, then, are used in the careful study of the emotion which the human face is expressing. The contrast between this approach by Ekman, and the general rating-judgment approach used in studies of infant emotion, is noteworthy. If Ekman's Facial Affect Scoring Technique is validated successfully with infants we will have the first indication of the means by which discrete emotions are expressed.

Ekman, Izard, and Tomkins leave the way open for psychobiological advances beyond their present positions. Facial expressions, of course, are but the end result of the activation of patterns of facial muscles. Anatomically, the "muscles of facial affect" have been known for nearly a century. A schematized photograph of the facial musculature, taken from Tomkins' book, is illustrated in Slide 1. Since electromyographic recording methods can detect implicit muscular activity through simple surface electrodes, we can sample patterns of IMPLICIT facial expression even when the OVERT facial expression is poker-faced, or in the language used by infant researchers, "sober." Thus, it may be possible to record anticipations of smiling from the zygomaticus muscle well before the sober face breaks into an overt smile, or, for that matter, even if it never does. It may also be possible to record implicit "crying" activity by detecting increased EMG over the Triangularis muscle, implicit fear or surprise by measuring the activity of the appropriate muscle groups. In fact, using EMG techniques to uncover "masked" facial behaviors has already been used successfully with adults by Schwartz and his collaborators at Harvard (Schwartz, Fair, Greenberg, Foran, & Klerman, 1974).

Facial behaviors, thus, can provide researchers both considerable specificity of information, and great sensitivity in registering affective reactions. In addition, the methodology is objective, and has reference to underlying anatomical and neurophysiological patterns known to be involved in the expression of discrete emotions. While such sensitivity of measurement of emotional states may not be necessary for testing many hypotheses about emotion in infants, and while the EMG measurements are at present quite intrusive, it is comforting to know that such sensitivity and accuracy is potentially available. Furthermore, future technology may develop less invasive means of measuring implicit muscle activity (e.g., through precise photography).

These three approaches--learning, psychophysiology, and analysis of patterns of facial expressions--thus can broaden considerably the response measurement techniques whereby emotion can be inferred appropriately in the infant. Of course, numerous other problems face the researcher of infant emotion. Two come immediately to mind. One is the appropriate use of stimulating circumstances used to elicit responses in the infant (a concern which occupied much of Rheingold and Eckerman's [1973] critique). The second problem concerns how to handle blends of emotional reactions--i.e., the simultaneous expression of two possibly very different emotions, such as fear and happiness. The latter is a problem not often discussed by researchers in infancy.

Nevertheless, the considerations put forth in this paper lead to two tentative conclusions. First, we often do not need to be able to specify the exact emotion that an infant is expressing in studies of emotional development. Secondly, objective, sensitive, and valid operations exist for testing infant emotional expression. Some of these operations are more suitable for testing the expression of general, superordinate categories of emotion (e.g., distress, which could be due to anger, fear, or sadness). Other operations (such as the analysis of facial patterns) offer hope, on the other hand, for operationalizing much more discrete emotional states.

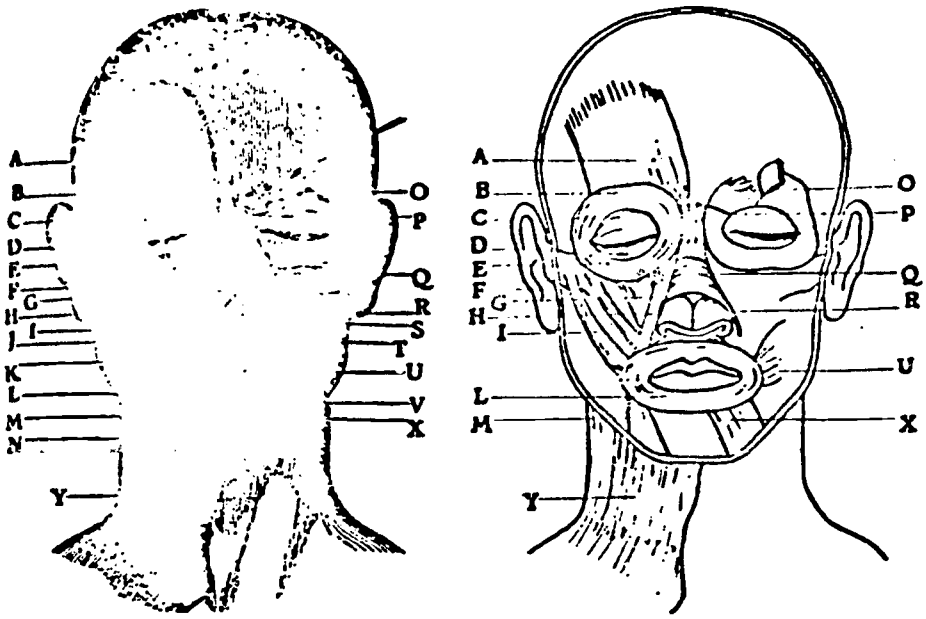

Figure 1 Anatomic preparation of the muscles of the face, as presented by Duchenne (left drawing). The simpler drawing on the right follows the old illustration but attempts clarification where possible.

A. Frontalis, muscle of attention. B. Orbicularis oculi (pars palpebralis), muscle of reflection. C and D. Palpebralis superior and inferior, muscle of contempt and complementary muscle of weeping. E. Orbicularis oculi (extra palpebralis inferior or pars orbitalis), muscle of benevolence and complementary of frank joy. F. Caput zygomaticum of quadrati labii superioris, muscle of moderate weeping and grief. G. Caput infra orbitalis of quadrati labii superioris, muscle of weeping. H. Caput angulare of quadrati labii superioris, muscle of whimpering. I. The zygomaticus, muscle of joy. K. Masseter. L. Orbicularis oris. M. Triangularis, muscle of sadness and complementary of aggressive passions. N. Mentalis. O. Corrugator supercilii, muscle of anguish. P. Procerus nasi, muscle of aggression. Q. Nasalis, muscle of lasciviousness and lewdness. R. Pars alaris of m. Nasalis, a complementary muscle of expression of passion. U. Buccinator, muscle of irony. V. Deep fibers of the orbicularis oris in continuation with the buccinator. X. Quadratus labii inferioris, complementary muscle of irony and aggression. Y. Platysma, muscle of fright and of scare, and complementary to anger.

Slide 1. Taken from Tomkins, 1962.

Stranger Distress as an Expectable Developmental Event

Theodore J. Gaensbauer

Distress to a stranger has traditionally been considered to be an expectable developmental event with the usual onset between seven and nine months. Recently, its universality has been questioned by several researchers, primarily on the grounds that the distress response is unstable and that a large number of infants at these ages show positive rather than negative responses to strangers. As previous panelists have pointed out, a distress response to a stranger is certainly not an "all-or-nothing" event, and the complexities of definition, methodology, and measurement have made conclusions about universality difficult. Given the criticisms of past studies, and the various issues discussed here today, the question remains, "Is stranger distress a normal developmental event seen in all infants with an onset during the second half of the first year?"

Whether stranger distress is an expectable developmental event can only be answered definitively by longitudinal study, since in a cross-sectional study variations in time of onset or modifications in the pattern of response following onset could influence the number of infants showing the response in any given month. The studies showing that a large number of infants at a given age do not show distress have generally been cross-sectional, for example, Scarr and Salapatek (1970), Morgan and Ricciuti (1969), Rheingold and Eckerman (1973), while the longitudinal studies of Tennes and Lampl (1964) and Schaffer (1966) found distress to occur in practically all infants at some point during the first year.

In our laboratory, we have recently completed a longitudinal study of 14 infants' response to strangers during the first year of life. Our procedure involved monthly home visits during which the infant was exposed to two stranger approaches, first in mother's absence and then in her presence. Our stranger sequence involved a silent though naturalistic approach to within three feet of the infant, followed by a low-volumed greeting and ultimately a gentle picking up of the infant, each phase lasting approximately one minute. A 30-60 second baseline period without distress perceded the stranger's entrance. The entire sequence was filmed and subsequently rated for facial expressions on a five-point scale, including smiling, neutral expressions ranging from fascinated curiosity to sober expressions, frowning, whimpering and crying, with inter-rater reliability of 88%.

Our results were fully consistent with the previously reported longitudinal studies. All 14 infants showed stranger distress as defined by pronounced frowning, whimpering, or crying during the first year with a mean age of onset of 8.4 months for the first stranger and 8.1 months for the second stranger. The range of onset was 5 to 12 months, with 11 of 14 infants having shown distress by 9 months of age. We feel the term "onset" is justified, in that once present, stranger distress usually occurred to both strangers at the same visit and fairly consistently over the next several visits. Eleven of 14 infants showed distress for two months consecutively and 8 of 14 for three months consecutively.

Under our conditions, the developmental course of stranger responses involved two opposite functions: a decrease in positive behaviors (i.e., smiling) directed at the stranger with age, and an increase in negative

behaviors (i.e., frowning, fussing, or crying). Up to 5 months, responses were highly positive. All infants smiled to the first stranger at 4 months, and all but 3 at 5 months. Frowning was virtually non-existent at 4 and 5 months. During the sixth through eighth months, smiling became less frequent while instances of frowning increased. A neutral expression was by far the most common during this period. Between 7 and 9 months, there was a sharp increase in distress reactions; at 6 months only 3 infants showed frowning or crying to the first stranger, whereas at 9 months 11 of 14 infants showed negative reactions. From the ninth month on, smiling was rare; there were an average of 2 infants per month smiling to the first stranger during months 9 through 12. With the second stranger (mother present), the findings were in a similar direction, though mother's presence tended to have a comforting effect. There were fewer instances of frowning, whimpering, or crying and increased instances of smiling in the later months when mother was present.

Not only was smiling infrequent during the 9-to 12-month period, but when seen was often reflective of an ambivalent response rather than the unreserved pleasure which characterized the 4-to 5-month period. Of the 31 episodes of smiling to either stranger in these later months, 10 involved transient smiles superimposed on a basically serious or sober expression and 8 involved smiles which occurred initially in a sequence in which frowning or crying subsequently occurred and in which stranger distress was rated as present.

We conclude that, given sufficient conditions, all infants will show a shift in their response to a stranger from positive to negative, usually occurring in the third quarter of the first year. The notion that part of

the controversy on this issue results from the potentially misleading use of cross-sectional data was supported when we looked at our own data cross-sectionally. Though all infants showed a distress response at some point in the first year, at any given age anywhere from 35% to 50% of the infants tested did not show distress. These percentages were roughly equivalent to the percentages of stranger distress reported by other investigators for comparable ages.

It is clear that the infant's response to a stranger varies considerably under different conditions. Does this variability in response invalidate the conclusion that stranger distress is a developmental event? In my opinion it does not. Though it is clear that distress reactions are more likely when an intrusive approach such as our own is used, even with much less intrusive interactions, some evidence of wariness to unfamiliar adults has generally been found when looked for. My hypothesis would be that this capacity for wariness does not appear in consistent form prior to the third quarter of the first year. What is demonstrated from our own data is that an identical experimental sequence which evokes smiling and delighted curiosity in the 4-to 6-month-old rather abruptly produces frowning and overt distress in the 8-to 9-month-old. With few exceptions, the many other studies of this phenomenon confirm this impression. Relatively few instances of stranger distress are seen prior to 6 months, while a sharp increase in incidence is observed between 7 and 10 months.

In this sense, the onset of wariness between 7 and 9 months may not be limited to strangers. Recent publications suggest a shift to a fear response

to other stimuli as well; for example, to the visual cliff apparatus creating the illusion of height, the "loom-zoom" apparatus creating the impression of a fast approaching object, unfamiliar situations, and even to novel toys. We have speculated that fear of strangers may be only one expression of a general capacity for fearfulness developing at this time.

Although the capacity for a fear response may develop at this time, given the number of factors which influence emotional responses, one would not expect an overt fear response in every instance. From a methodological standpoint, it has been our rationale that, to test whether the potential for a given emotional response is present or absent, a sequence should be used which is likely to elicit the response if it is present. Perhaps an analogy could be drawn to developmental testing in other areas, where the infant is given every opportunity to demonstrate that he can perform a particular task.

In conclusion, though negative reactions to strangers are seen in all infants with a fairly expectable time of onset as a manifestation of normal development, many questions remain to be clarified. The relative contributions of maturation versus learning, the different conditions influencing either positive or negative responses and their stability over time, and the theoretical implications for subsequent development are among the issues which further research will elucidate. Yet, to begin to describe the full range of the 6-to 12-month-old infant's responses to strangers will not require us to disregard the considerable evidence that fear is one possible reaction, and that the onset of a capacity for such fear has a developmental course.

Discussant's Comments

Ruth Solomon (Shaffran)

In considering the interesting papers just presented by Dr. Joseph Campos and by Dr. Theodore Gaensbauer, I would like to center my remarks on an issue which is central not only to both papers, but to all the research on fear of strangers. The issue is the universality of the fearful response. When researchers hold that the fearful response is universal, do they mean that at some point during the course of normal development all infants come to fear all strangers? Or do researchers mean that all infants will come to fear at least one stranger? Or are we asking the question, the very different question, at what point do infants develop the capacity to experience fear? This last question appears to be the question asked in Dr. Gaensbauer's paper.

Now, if as researchers we are asking whether infants naturally come to fear strangers (or, to use Dr. Campos' term, to find strangers aversive) without our deliberately trying to provoke an aversive reaction, then we must be very careful to use an approach to the child which is as similar as possible to the one which the child would encounter when faced with a stranger in real life. Secondly, we must be careful both in our experimental designs and in our interpretations, not to confuse reactions to strangers with separation anxiety. That is, we should not separate an infant from his mother (either in a familiar or an unfamiliar environment), have a stranger approach him, and then interpret the infant's reactions as a response to the stranger per se. Moreover we should avoid designs which permit possible carry-over effects from the distress which an infant may experience in a situation during which he is separated from his mother to a situation which follows shortly thereafter during which he is approached by a stranger in his mother's presence.

Dr. Gaensbauer found that all 14 subjects in his study showed stranger distress and reports a mean age of onset. He feels that the term onset is justified because of intra- and inter-visit stability of the negative response. His findings, therefore, show the negative response to be stable. However our data (Shaffran and Decarie, 1973) stand in direct contradiction to his. We found that infants who responded negatively to one stranger did not maintain such a response for three days. On the contrary, almost all of our subjects who were negative to one stranger were very friendly to one or two other strangers within that brief period of time. No doubt differences in approach and perhaps scoring play a role in the differences between our results and those of Dr. Gaensbauer, but more importantly the differences in the results point up the difficulty of pinning down the facts in this area of child development. A further example of these difficulties is that contrary to the findings just reported by Dr. Campos we have found more negative responses to strangers in the home than in the lab!

Turning now to the other question: At what point do infants develop the capacity to experience fear? With this question we are, I believe, into a very different area. We have to ask what is fear and how do we define it? I can tell you of some experiences from our own lab. One is that of Provost and Decarie, to whom Dr. Campos just referred, who had to approach over 40 infants before they could gather together a sample of about nine who were negative to a stranger. It was very hard to find infants who didn't like strangers. How then does one evoke fear? We tried to evoke it, in order to define it, by having 20, 13- to 17-month-old infants come to the lab where we put them in the most fear producing (while ethical) situation we could think of, the visual cliff. However, we could not get inter-judge agreement that there was any fear.

We got significant agreement for interest, anger, and joy, but not for fear. As a matter of fact the judges who were naive and did not know the real purpose of the experiment hardly mentioned fear.

In completing these brief remarks, I would like to say that I agree with Dr. Campos that the answer to some of these questions may lie in the use of methods such as heart rate and other objectively measurable psychophysiological responses.

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